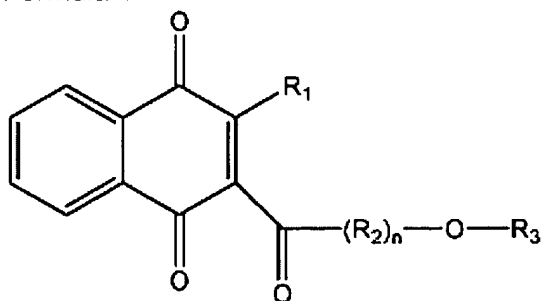


CLAIMS

What is claimed is:

1. A naphthoquinone derivative represented by Formula 1:

Formula 1



wherein:

R_1 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms;

R_2 is selected from the group consisting of an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms;

n is 0 or 1; and

R_3 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, and a group represented by Formula 1a or 1b:

Formula 1a

$-R_4-O-R_7$

Formula 1b

$-R_5-O-R_6-O-R_7$

wherein:

R_4 , R_5 , and R_6 are selected from the group consisting of, independently, an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms; and

R_7 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms,

wherein the naphthoquinone derivatives having the Formula 1, where $n=0$, R_3 is a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, or a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, are excluded.

2. The naphthoquinone derivative according to claim 1, wherein n is 1, R_2 is a phenylene group and R_3 is a methyl group.

3. The naphthoquinone derivative according to claim 1, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene group, and R_7 is selected from the group consisting of a tert-butyl, a phenyl, a benzyl, a 4-nitrophenyl, an isopropyl, an ethyl, a 4-tert-butylphenyl, and a 4-nitrophenylmethyl group.

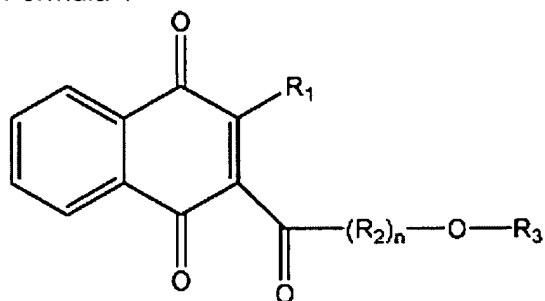
4. The naphthoquinone derivative according to claim 1, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a phenylene group, and R_7 is a butyl group.

5. The naphthoquinone derivative according to claim 1, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a methylene-phenylene group, and R_7 is selected from the group consisting of $-\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)_2$, $-\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)(\text{CH}_2)_3\text{CH}_3$, a methyl group, and an isopropyl group.

6. The naphthoquinone derivative according to claim 1, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene-phenylene group, and R_7 is an n-butyl group.

7. An electrophotographic photoreceptor comprising:
a substrate; and
a photosensitive layer comprising a naphthoquinone derivative represented by Formula 1:

Formula 1



wherein:

R_1 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms;

R_2 is selected from the group consisting of an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms;

n is 0 or 1; and

R_3 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, and a group represented by Formula 1a or 1b:

Formula 1a

$-R_4-O-R_7$

Formula 1b

$-R_5-O-R_6-O-R_7$

wherein:

R_4 , R_5 , and R_6 are selected from the group consisting of, independently, an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms; and

R_7 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms,

wherein the naphthoquinone derivatives having the Formula 1, where $n=0$, R_3 is a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, or a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, are excluded.

8. The electrophotographic photoreceptor according to claim 7, wherein n is 1, R_2 is a phenylene group and R_3 is a methyl group.

9. The electrophotographic photoreceptor according to claim 7, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene group, and R_7 is selected from the group consisting of a tert-butyl, a phenyl, a benzyl, a 4-nitrophenyl, an isopropyl, an ethyl, a 4-tert-butylphenyl, and a 4-nitrophenylmethyl group.

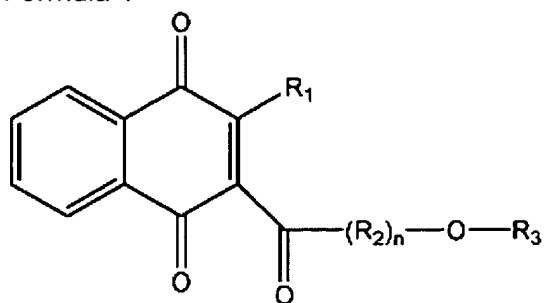
10. The electrophotographic photoreceptor according to claim 7, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a phenylene group, and R_7 is a butyl group.

11. The electrophotographic photoreceptor according to claim 7, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a methylene-phenylene group, and R_7 is selected from the group consisting of $-\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)_2$, $-\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)(\text{CH}_2)_3\text{CH}_3$, a methyl group, and an isopropyl group.

12. The electrophotographic photoreceptor according to claim 7, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene-phenylene group, and R_7 is an n-butyl group.

13. An electrophotographic drum, comprising:
a drum;
a substrate disposed on the drum; and
an electrophotographic photoreceptor disposed on the substrate, the electrophotographic photoreceptor comprising:
a substrate; and
a photosensitive layer comprising a naphthoquinone derivative represented by Formula 1:

Formula 1



wherein:

R_1 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms;

R_2 is selected from the group consisting of an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms;

n is 0 or 1; and

R_3 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, and a group represented by Formula 1a or 1b:

Formula 1a

$-R_4-O-R_7$

Formula 1b

$-R_5-O-R_6-O-R_7$

wherein:

R_4 , R_5 , and R_6 are selected from the group consisting of, independently, an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms; and

R_7 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms,

wherein the naphthoquinone derivatives having the Formula 1, where $n=0$, R_3 is a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, or a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, are excluded,

wherein the electrophotographic drum is attachable to/detachable from an image forming apparatus.

14. The electrophotographic drum according to claim 13, wherein n is 1, R_2 is a phenylene group and R_3 is a methyl group.

15. The electrophotographic drum according to claim 13, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene group, and R_7 is selected from the group consisting of a tert-butyl, a phenyl, a benzyl, a 4-nitrophenyl, an isopropyl, an ethyl, a 4-tert-butylphenyl, and a 4-nitrophenylmethyl group.

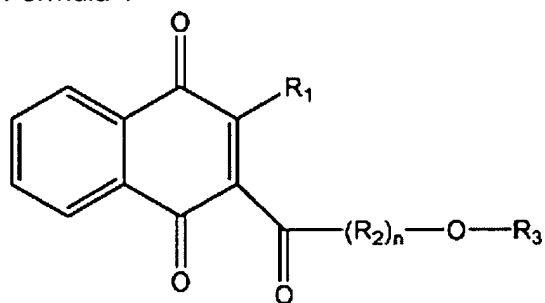
16. The electrophotographic drum according to claim 13, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a phenylene group, and R_7 is a butyl group.

17. The electrophotographic drum according to claim 13, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a methylene-phenylene group, and R_7 is selected from the group consisting of $-\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)_2$, $-\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)(\text{CH}_2)_3\text{CH}_3$, a methyl group, and an isopropyl group.

18. The electrophotographic drum according to claim 13, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene-phenylene group, and R_7 is an n-butyl group.

19. An electrophotographic cartridge, comprising:
an electrophotographic photoreceptor comprising:
a substrate; and
a photosensitive layer comprising a naphthoquinone derivative represented by Formula 1:

Formula 1



wherein:

R_1 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms;

R_2 is selected from the group consisting of an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms;

n is 0 or 1; and

R_3 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, and a group represented by Formula 1a or 1b:

Formula 1a

$-R_4-O-R_7$

Formula 1b

$-R_5-O-R_6-O-R_7$

wherein:

R_4 , R_5 , and R_6 are selected from the group consisting of, independently, an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms; and

R_7 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms,

wherein the naphthoquinone derivatives having the Formula 1, where $n=0$, R_3 is a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms; or a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, are excluded.

20. The electrophotographic cartridge according to claim 19, wherein n is 1, R_2 is a phenylene group and R_3 is a methyl group.

21. The electrophotographic cartridge according to claim 19, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene group, and R_7 is selected from the group consisting of a tert-butyl, a phenyl, a benzyl, a 4-nitrophenyl, an isopropyl, an ethyl, a 4-tert-butylphenyl, and a 4-nitrophenylmethyl group.

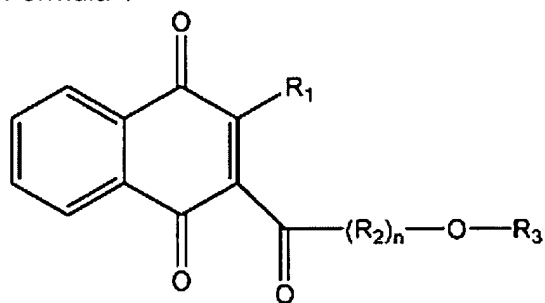
22. The electrophotographic cartridge according to claim 19, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a phenylene group, and R_7 is a butyl group.

23. The electrophotographic cartridge according to claim 19, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a methylene-phenylene group, and R_7 is selected from the group consisting of $-\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)_2$, $-\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)(\text{CH}_2)_3\text{CH}_3$, a methyl group, and an isopropyl group.

24. The electrophotographic cartridge according to claim 19, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene-phenylene group, and R_7 is an n-butyl group.

25. An image forming apparatus, comprising:
a photoconductor unit having an electrophotographic photoreceptor, the electrophotographic photoconductor comprising:
a substrate; and
a photosensitive layer comprising a naphthoquinone derivative represented by Formula 1:

Formula 1



wherein:

R_1 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms;

R_2 is selected from the group consisting of an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms;

n is 0 or 1; and

R_3 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, and a group represented by Formula 1a or 1b:

Formula 1a

$-R_4-O-R_7$

Formula 1b

$-R_5-O-R_6-O-R_7$

wherein:

R_4 , R_5 , and R_6 are selected from the group consisting of, independently, an alkylene group having 2 to 20 carbon atoms, an arylene group having 6 to 30 carbon atoms, and an arylene-alkylene group having 7 to 30 carbon atoms; and

R_7 is selected from the group consisting of a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, and a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms,

wherein the naphthoquinone derivatives having the Formula 1, where $n=0$, R_3 is a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 carbon atoms, or a substituted or unsubstituted aralkyl group having 7 to 30 carbon atoms, are excluded,

a charging device which charges the photoconductor unit;

an imagewise light irradiating device which irradiates the charged photoconductor unit with imagewise light to form an electrostatic latent image on the photoconductor unit;

a developing unit that develops the electrostatic latent image with a toner to form a toner image on the photoconductor unit; and

a transfer device which transfers the toner image onto a receiving material,

26. The image forming apparatus according to claim 25, wherein n is 1, R_2 is a phenylene group and R_3 is a methyl group.

27. The image forming apparatus according to claim 25, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene group, and R_7 is selected from the group consisting of a tert-butyl, a phenyl, a benzyl, a 4-nitrophenyl, an isopropyl, an ethyl, a 4-tert-butylphenyl, and a 4-nitrophenylmethyl group.

28. The image forming apparatus according to claim 25, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a phenylene group, and R_7 is a butyl group.

29. The image forming apparatus according to claim 25, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is a methylene-phenylene group, and R_7 is selected from the group consisting of $-\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)_2$, $-\text{CH}_2\text{CH}(\text{C}_2\text{H}_5)(\text{CH}_2)_3\text{CH}_3$, a methyl group, and an isopropyl group.

30. The image forming apparatus according to claim 25, wherein n is 0, R_3 is $-R_4-O-R_7$ of the Formula 1a, R_4 is an ethylene-phenylene group, and R_7 is an n-butyl group.